

ARE HEALTH CARE COSTS/PAYMENTS INFLUENCED  
BY COMPUTERIZED OPTIMIZATION

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## INTRODUCTION

In 1983, Congress passed the Social Security Amendments (Public Law 98-21) which mandated an end to cost-reimbursement for Medicare inpatients. This law established the prospective payment system(PPS) for hospital Medicare inpatient reimbursement. PPS is a fixed per-case payment system for patients in 468, now 494, diagnosis-related groups(DRGs) (Office of Technology, 1986).

"DRGs are a patient classification system developed to reflect differences in predicted resource use among different kinds of hospital patients" (Office of Technology, 1986).

There are three basic incentives for hospital managers and physicians under a per-case pricing system. The incentives are:

- to reduce cost per admission;
- to increase the number of profitable admissions;
- offer new services not covered by payment restrictions.

The profitability of any admission depends on the price paid. The price paid depends on the DRG to which the admission is classified (Office of Technology, 1986).

"Hospitals also have an incentive to assign patients to DRGs that will provide the greatest possible revenue" (Office of Technology, 1986). A computer program, called a GROUPER, uses diagnostic, procedure codes, and patient age

to make DRG assignments. Under the medicare reimbursement system prior to PPS, accurate diagnostic and procedural coding was not crucial to the payment process and many errors appear to have occurred. Hospitals now have an incentive to code accurately and to "report codes that will maximize payment levels" (Office of Technology, 1986).

The implementation of any policy leads to adaptation as the policy evolves in response to its environment. Unforeseen consequences are to be expected. During adaptation, decision-making is dispersed (Pressman, 1984). What this means is that each agency or provider involved in the implementation of the policy adapts to make the policy work to their particular advantage. Since Medicare reimbursement is determined by the DRG assignment, the way in which providers responded to the policy may have influenced the final DRG payment.

"Since administrative discretion can be used as a cover for arbitrary behavior that is unrelated to policy intentions, some authors feel that the problem of administration is, purely and simply, one of controlling discretion" (Pressman, 1984).

If Pressman is correct about discretion, the intent of the Medicare Prospective Payment System to control Medicare expenditures for hospital care can only be realized if a method is found to control the amount of discretion used by providers.

## LITERATURE REVIEW

Discretion

The topic of discretion needs to be explored since the amount of discretion applied, at all levels of policy implementation, could lead to a totally different outcome than was intended by policy makers.

Webster defines the word discretion as follows:

"power of decision: individual judgement; power of free decision or choice within which a court or judge decides questions arising in a particular case not expressly controlled by fixed rules of law according to the circumstances and according to the judgement of the court or judge; ability to make decisions which represent a responsible choice and for which an understanding of what is lawful, right, or wise may be presupposed"(Webster. 1986).

Discretion in decision making is not limited to health care. A good example is the criminal justice system and the impact of discretionary decisions on prison overcrowding. Attempts to control discretionary decision making in California only resulted in a shifting of the discretion from one decision maker to another (McCoy, 1984).

California's Determinate Sentencing Law (D.S.L.), 1977, was enacted to shift discretion from parole decision makers to the sentencing judges. By controlling discretionary power, legislators and voters wanted to increase the severity of punishment for felons and prevent the parole board from releasing prisoners too soon (McCoy, 1984). The result was that discretion shifted to the district

attorneys. Plea bargaining became the determinator of the sentence. As a result, California passed Proposition 8 which banned plea bargaining in 1982. Proposition 8, however, contains a loop-hole and the district attorneys still have discretionary plea bargaining ability in the Municipal Courts. According to McCoy, since the elimination of the parole board discretionary decisions, prison populations have increased in California.

The major purpose of the Prospective Payment Plan is to hold down the rise in Medicare expenditures (Pozgar, 1987). However, the system allows for considerable discretion, on the part of both the payers and the providers, in determining the DRG, and therefore, the payment for the patients' medical care. For example, if a patient is admitted with multiple problems, Medicare and the hospital may determine two completely different principal diagnoses based on individual review of the medical record and interpretation of the coding rules and the medical record.

#### Discretion in Medicare Billing

"Upon discharge from the hospital, the attending physician must document the principal diagnosis (i.e., 'the condition established after study to be chiefly responsible for occasioning the admission of the patient to the hospital for care'; HCFA). In addition, specific reference must be made to significant comorbidities (i.e. secondary diagnoses), complications and significant operative and non-operative diagnostic and therapeutic procedures performed"(Blue Cross, 1990).

This policy for documentation is the basis for the information about the patient's health care that determines the DRG to which the patient is classified. How this policy is interpreted by HCFA, the fiscal intermediary (in Michigan, Blue Cross or Travelers), the physicians and the hospitals can have an impact on the price paid for a specific patient's care.

Operationally, Medicare reimbursement depends upon proper application of coding rules (Hsia, 1992). Often, the hospital, Medicare reviewers and the physicians do not agree on the reason the patient was admitted to the hospital and therefore, they do not agree on the principal diagnosis. This disagreement results in a conflict over the payment.

### Hospital Discretion

Even before implementation of the PPS/DRG system by Medicare, studies showed that there was a way to optimize a DRG payment by resequencing diagnoses and the ICD-9-CM codes. In one study, a computer program was written to reverse the principal and second diagnoses and recalculate the DRG. "In twenty-three percent of the cases, the reversed sequence of the first two listed diagnoses would have been the costlier sequence" (Sounding Board, 1981). The author of this article "imagined" a sophisticated computer system with tables developed for diagnostic combinations to allow switching of the sequence of the



first and second diagnoses in situations in which either could be appropriately considered the principal diagnosis" (Sounding Board, 1981).

He further hypothesized that another computer program could be developed to audit abstracts and identify cases for further review for potential increase in payment by resequencing of codes (Sounding Board, 1981). Both of these systems are a reality and in use by hospitals today and are at the heart of hospital "discretion" and Medicare billing.

An additional method to increase reimbursement is by physician education in the appropriate documentation of diagnoses and procedures. "Minor diagnostic nuances and slight imprecisions of wording have little practical clinical importance, yet under DRG reimbursement they would have major financial consequences" (Sounding Board, 1981). There are health care consulting companies that work with hospitals to educate physicians in documentation methods for DRG assignment.

With the implementation of DRGs, cooperation of the physicians, in timely and accurate documentation, has become one of the most important links to reimbursement. The hospitals literally have taught physicians to document the "best" principal diagnosis and all other diagnoses the patient is treated for, as well as any complications and all procedures which occurred during the admission (Bennett, 1984).

### Physician Discretion

Concern has been raised about the ability of the DRG system to control health care costs. However, the DRG system doesn't take into consideration the importance of physician practice styles in determining hospital case mix (Wennberg, 1985). It now appears that physician discretion plays an important role in DRG assignment.

Studies have shown that "differences in illness rates cannot provide an adequate explanation for the differences in hospitalization rates seen" (Wennberg, 1985). Variations in observed rates, he suggests, must be due to incidences of conditions in hospital markets or "peculiarities" in coding practices. Much of the observed variation in rates appears to result from the physicians' options to admit or from their differing use of the ICD-9-CM system (Wennberg, 1985).

### Diagnostic Related Groups

The diagnostic-related groups used in Medicare's PPS are based on a coding and classification system known as the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) (Office of Technology, 1986). ICD-9-CM has two parts, one is a list of diagnoses codes and the other is a list of procedure codes. Both the disease and procedure codes are organized according to organ system with additional sections for subjects such as infectious diseases and accidental injuries. Diseases are

assigned three to five digits to allow for specificity. The procedure codes have a maximum of four digits (Office of Technology, 1986).

"ICD-9-CM was not developed to serve as the basis for provider reimbursement" (Fox, 1992). The purpose of ICD-9-CM was to classify morbidity data to be used to evaluate care, plan health care delivery systems, analyze payments for services and for conducting epidemiological and clinical research (Fox, 1992). Therefore, the coding system was wide-open for discretionary interpretation by Medicare, physicians and hospitals in its use for assigning DRGs.

DRG assignment depends on both diagnosis and procedure codes. The presence or absence of a procedure code determines whether the DRG is medical or surgical. The principal diagnosis code places the patient in the appropriate major diagnostic category (Office of Technology, 1986). The principal diagnosis is the diagnosis, which after study, is most closely related to the reason for admission. The secondary diagnosis indicates the presence of a complication or comorbid condition.

Generally, surgical DRGs have a higher reimbursement rate than the medical DRGs. Inaccurate or inadequate coding could lead to incorrect DRG assignment and, therefore, inaccurate reimbursement. Also, some medical conditions can be described by more than one diagnostic code. All of the codes may be technically correct but could lead to different

DRG assignments--thus different reimbursement (Office of Technology, 1986).

As DRG reimbursement levels have been reduced, the accuracy of coding and DRG assignment has become a higher priority in hospitals. The manual assignment, by medical record professionals, of codes and the proper sequencing of codes to ensure an accurate DRG, is no longer adequate. More hospitals are purchasing computerized encoders and groupers to aid the process.

Although only one research study has been published to indicate that a computerized system increases reimbursement over the manual system, hospital management, peer review organizations and third party payers have long felt that the computer does optimize reimbursement. Many articles have been published concerning the phenomena of 'DRG Creep'--the concept that providers are maximizing diagnoses (ie: shift a patient from 1 diagnosis to a higher paying other diagnosis) to obtain a higher rate for their patients.

"DRG Creep may be defined as a deliberate and systematic shift in a hospital's reported case mix in order to improve reimbursement" (Spiegel, 1986). In order to understand the importance of DRG Creep, it is necessary to understand the concept of case mix.

Case mix management is one of the most important challenges hospitals face. Case mix is the hospital's mix of products or DRGs. Hospital product lines are patient

groupings. Case mix can be defined as the "distribution of a hospital's patients among different diagnostic, age, and operative groups" (Spiegel, 1986).

Case mix is an index of the "relative costliness of the inpatient cases treated in a particular hospital compared to those treated in the 'average' or 'typical' hospital" (Spiegel, 1986). The case mix index for all hospitals is 1.0; hospitals with case mixes above 1.0 spend more to treat their patients while hospitals with case mix below 1.0 spend less (Spiegel, 1986). For example, the case mix for St. Joseph Mercy Hospital, Ann Arbor, for fiscal year 1993. was 1.65; which makes sense, in that this facility sees patients with major cardiac, orthopedic and oncology conditions which require more resources to treat.

The government reacted to DRG Creep in 1984 when the national case mix for hospitals showed an increase of 5.8 percent. This was an increase of 2.4 percent above the expected rate and HCFA(Health Care Financing Administration) felt it was due to manipulation of DRGs. The American Hospital Association claimed it was due to better coding and identification of principal diagnoses by the hospitals (Spiegel, 1986). So Congress created the peer review organizations(PROs) to, among other things, verify the accuracy of hospital coding for billing (Hsia, 1992).

Summary of the Literature Review

Table 1 provides the results of the literature review in tabular form and indicates when the author supported the theory that increased reimbursement, or case mix, was due to hospitals' application of coding and sequencing capabilities. Only one study was found that actually documented the results of any research on computer optimization. However, literature was found supporting the fact that hospital case mix values have increased, and that the increase may be due to hospital application of coding rules and sequencing (Bennett, 1984).

Table 1

Studies of Optimization and DRG Manipulation

Author	Type of Support	
	Coding	Sequencing
Office of Technology, 1986	x	x
Bennett, 1984	x	
Spiegel, 1986	x	x
Blue Cross, 1990	x	
Gardner, 1992	x	
Hsia, 1992	x	
Fox, 1992	x	
Wennberg, 1985	x	
Sounding Board, 1981		x

## THEORY/HYPOTHESIS

In the absence of an existing theory, I propose the Theory of Optimization: The theory is that the use of computerized encoders and groupers allow medical record professionals to increase the payment per discharge for Medicare inpatients by applying coding rules more consistently and by allowing resequencing of codes to higher weighted DRGs. This optimization of coding and sequencing results in an increase in cost for the Medicare program to cover inpatient services.

The literature review supports the theory that the increased cost of Medicare is due to the optimization by hospitals using better coding and sequencing. If this theory is true, then it should be possible to show an increase in case mix and, therefore, an increase in payment following implementation of coding and sequencing software.

The cost of Medicare inpatient health care (dependent variable) has increased since the implementation of DRGs due to the increase in hospitals' case mix (dependent variable) which is caused by the implementation of computerized encoders and groupers (dependent variables). The computerized optimizer identifies for the coder possible complications and comorbidities that frequently accompany a specific diagnosis. In addition, the software alerts the coder to diagnoses which are not acceptable as principal diagnoses and flags diagnoses which could change the DRG

assignment and, therefore, the weight or payment for the case.

Therefore, my hypothesis is as follows:

H: The use of a computerized optimizer will  
increase case mix and, therefore, increase  
reimbursement.

Other variables which could impact the coding,  
sequencing and payment are:

1. coder experience;
2. physician documentation;
3. physician experience with DRGs;
4. on-going education of coders and physicians;
5. changes in patient volumes within DRGs;
6. revisions to ICD-9-CM codes;
7. revisions in DRG weights;
8. revisions in DRGs.



## DESIGN/METHODOLOGY

To examine the impact of the computerized optimization, a retrospective study was conducted. This study investigated the impact of the use of a computer optimizer on Medicare reimbursement in a 750 bed acute care facility. A comparison of data before and after implementation of the optimizer was conducted to see if there was a significant increase in either case mix or payment.

The methodology consisted of analyzing data from 1989 (the year prior to computer implementation) by processing the data through the 1989 grouper (version 6) and also through the 1991 (the year following implementation of the computer) grouper (version 8). The 1991 data were also analyzed by processing through both versions 6 and 8 of the Medicare grouper. The data were also adjusted for coding and DRG changes in the two grouper versions.

The case mix index between the two years was compared before and after computerized grouping to determine the affect on the shift in DRG weights. Changes in volume in individual DRGs were also investigated to see if the volume change was responsible for an increase in CMI. The analytical method used to test the outcome was a t test.

Based on my experience, I expected to see an increase in CMI with the use of a computer optimizer program. I anticipated the following outcome:

1. since 1989 data were not computer optimized, the case mix for 1989 data using the 1991 grouper would be less than the 1991 CMI using the 1989 grouper;
2. since the 1991 data were optimized, the case mix for 1991 data using the 1989 grouper would be greater than the 1989 CMI using the 1989 grouper;
3. since 1991 data were optimized, the case mix and, therefore, the payment for 1991 would increase.

## RESULTS

The 1989 data were run through the 1991 grouper and the 1991 data were processed through the 1989 grouper. The results (Table 2) were as follows:

1. as predicted, the CMI for the 1989 data using the 1991 grouper(8), was markedly less than the 1991 CMI using the 1989 grouper(6) -- 1.3991 compared to 1.4163.
2. contrary to what was predicted, the CMI for the 1991 data, using the 1989 grouper(6), was not greater than the 1989 data using the 1989 grouper(6) --1.4163 compared to 1.5231.

TABLE 2

CMI/Number of Records by Fiscal Year and by Grouper

Fiscal Year/Grouper Version	CMI/#Records	
	CMI	Records
89		
6	1.5231	7749
8	1.3991	7749
91		
6	1.4163	8726
8	1.6519	8726

Figure 1 displays the CMI, by month, for the two fiscal years using the actual grouper in effect for that fiscal year. Both years tend to be parallel and follow seasonal ups and downs and the 1991 data are, on average, 15% higher than the 1989 data.

Figure 1

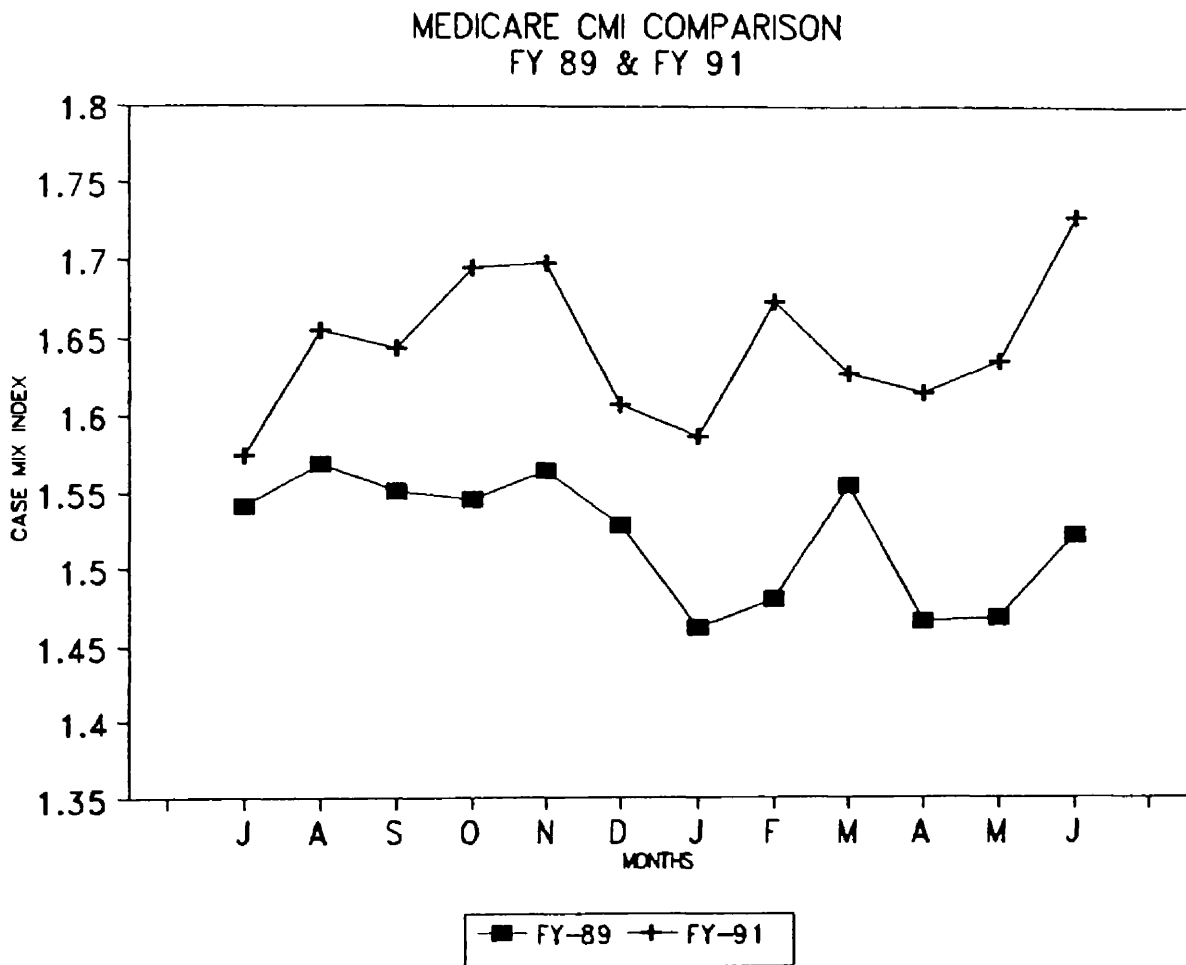


Figure 2 and Table 3 present the CMI by month, for FY 89 and FY 91 as calculated using both grouper 6 and 8 (ungroupable patients were removed). Note that the CMI values continue the seasonal trends apparent in Figure 1 (eg. lower values in December and January). Note also that the 1991 grouper (8) "bumps up" the CMI values to the extent that the average values for the fourth fiscal quarter of FY91 are 7.15 % higher than they would have been using Grouper 6 (1989).

An analysis was completed to determine if the percentage difference in actual CMI means between the two years was significant. Table 4 shows the difference was not significant in spite of the visual appearance, in Figure 2, of the 1991 line above (or higher) than the 1989 line.

TABLE 3

CMI/Discharge Month by Fiscal Year by Grouper Version


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Year/Month	Grouper/CMI		%DIFF 8over6	%DIFF Q AVG
	6	8		

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1989 Jul	1.5396	1.5096	-1.95	
Aug	1.5896	1.5382	-3.23	
Sep	1.5409	1.4742	-4.33	-3.17
Oct	1.5301	1.4680	-4.06	
Nov	1.5516	1.5037	-3.09	
Dec	1.5173	1.4711	-3.04	-3.40
Jan	1.4507	1.4227	-1.93	
Feb	1.4661	1.3875	-5.36	
Mar	1.5478	1.5623	0.94	-2.12
Apr	1.4591	1.4270	-2.20	
May	1.4438	1.4310	-1.25	
Jun	1.5002	1.4965	-0.25	-1.23
1991 Jul	1.4807	1.5268	3.11	
Aug	1.5971	1.6543	3.58	
Sep	1.5413	1.6239	5.36	4.02
Oct	1.5898	1.6556	4.14	
Nov	1.6004	1.6625	3.88	
Dec	1.4760	1.5800	7.05	5.02
Jan	1.4914	1.5523	4.08	
Feb	1.5542	1.6597	6.79	
Mar	1.4929	1.6213	8.60	6.49
Apr	1.4708	1.5644	6.36	
May	1.4719	1.5962	8.44	
Jun	1.5639	1.6679	6.65	7.15
Mean	1.5197	1.5440	1.60	
StndDev	0.0479	0.0846	4.44	

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Figure 2

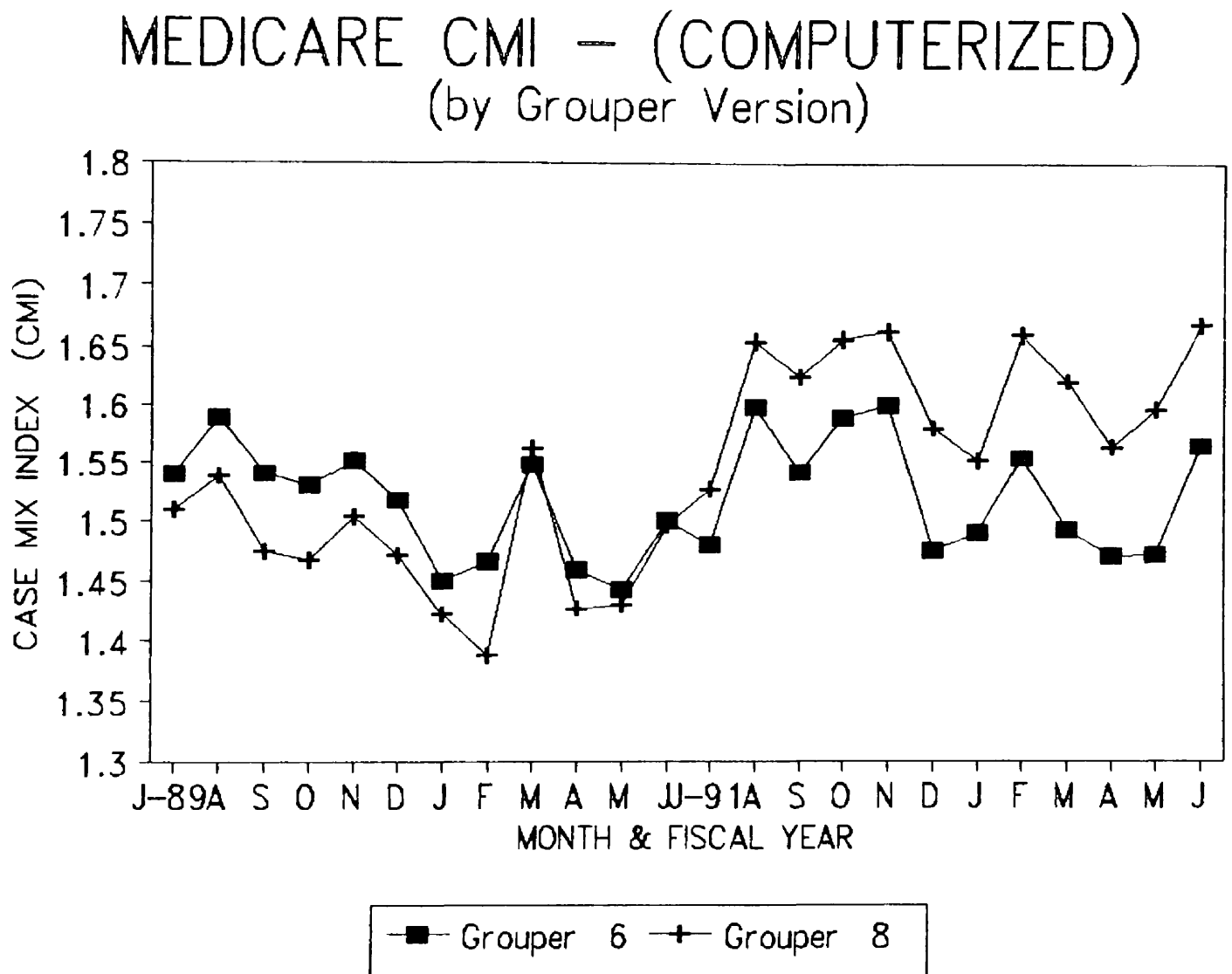


TABLE 4

Analysis of Yearly CMI Percentage Differences

	Percentage Difference	
	<u>FY89</u>	<u>FY91</u>
mean	.6020333	2.358367
S.D.	8.998166	8.894133
(n)	(12)	(12)
variance equality	F=1.02	
equal variance	t=-0.48	p=0.635

In an attempt to identify other factors which may have impacted the CMI, an analysis of the differences by quarter was completed. This information is displayed in Table 5. The differences between quarters were not considered to be significant at a  $p=0.343$ . There also was no significant interactive effect of the year and quarter.

TABLE 5

Impact of Quarter on CMI

Quarter	Fiscal Year	
	89	91
1	1.55	1.62
2	1.55	1.67
3	1.50	1.63
4	1.49	1.66

Quarter impact  $p=0.343$

Combined impact/ year and quarter interaction  $p=0.238$



To investigate the differences between the grouper populations, t-tests were performed on the data using Midas and Kwikstat software. The first test was conducted on the difference between the weights for each DRG in each grouper version (Table 2). Although the CMIs for each version did not change as expected, the grouper procedure produced significantly different CMIs for each year (Table 6).

In order to determine the impact of any code or DRG changes between the two groupers, t-tests were conducted on the populations removing the patients that were not groupable due to new or deleted codes or new DRGs. These tests also resulted in a significance of  $<.05$ . Table 7 presents the findings of these tests. It should be noted that by excluding the ungroupable patients, the populations decreased by 395 for FY89 and 632 for FY91.

Table 6

Two-Sample T-Test for Difference in Fiscal Year Weights  
Based on DRG Assignment

Version	Statistic		
	FY89	FY91	t-value
6	mean 1.5231	1.4163	5.4856 (p=<.001)
8	mean 1.3991	1.6519	-11.031 (p=<.001)
	(n) (7749)	(8726)	

Table 7

Two-Sample T-Test for Difference in Fiscal Year Weights  
Excluding Ungroupable Patients

Version				Statistic	
		FY89	FY91	t-value	
6	mean	1.5105	1.5269	.19194	(p=.8478)
	(n)	(7749)	(8094)		
8	mean	1.4742	1.6519	7.6410	(p=<.001)
	(n)	(7354)	(8726)		

Table 8 displays the difference in the DRG base payment before and after the implementation of the computer optimizer. The base payment is the average medicare payment per case for a hospital. The base payment is determined by the average case mix of the hospital. Therefore, as the case mix increases so does the payment. As was previously discussed and displayed in Table 6, the CMI significantly increased with the use of the computerized grouper or optimizer. This change in CMI had a direct impact on the average payment as shown in Table 8. The average payment increased from \$6108 per case to \$7180 per case following implementation of the computer. This was an 18% increase in payment per case which was significant at a  $p < .05$ .

Table 8

Two-Sample T-Test for Change in DRG Base Payment

Variable	Statistic		
	FY89	FY91	t-value
Mean Payment	\$6108	\$7180	11.106 (p=<.001)
S.D.	\$4897	\$6536	
(n)	(7749)	(8726)	
Change	17.55%		

## DISCUSSION

Based on the statistical analyses, the finding that computerized optimization results in increased case mix, increased reimbursement from grouper adjustments cannot be discounted.

While there are still some limitations with the analyses, such as the unknown changes in codes within the DRGs, the elimination or exclusion of complications or comorbidity codes within a DRG or the actual elimination or addition of DRGs, the areas of significance cannot be ignored. The following were significant: the differences in fiscal year weights, and the difference in base payment. Also, attempts to identify variances and their significance to the change did not provide any concrete reasons for the change in CMI and payment. Variables such as month to month changes, quarterly changes and, therefore, seasonal changes were not significant.

## CONCLUSION

Based on the results of this research, there is evidence to indicate that the use of a computer optimizer does have an impact on increased case mix and increased reimbursement.

The impact of this study is two fold: from a provider's point-of-view, the use of increased case mix or reimbursement as a cost justification for a computer optimizer may be valid. However, from the federal government's point-of-view, discretionary coding or sequencing may be a significant factor in the increases in health care costs reported in the literature.

The purpose of the PPS system was to hold down the rise of Medicare expenditures (Pozgar, 1987). In 1984, case mix for hospitals showed an increase of 5.8 percent. This was 2.4 percent above the expected increase and HCFA felt that it was due to manipulation of DRGs by the hospitals (Spiegel, 132). This was before computer optimizers were commonly available. If all Medicare certified hospitals purchased these computer programs and experienced a similar rise in CMI(15%) as the sample hospital, there would probably be a comparable rise in payment per case and therefore, an overall and perhaps dramatic increase in Medicare expenditures. These changes in case mix and payment would occur without any actual change in the patient mix, the care provided or the resources used to provide care.

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